

Onset of the combined orbital-spin ordering and of the spin-triplet pairing induced by the Hund's rule coupling

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Current theoretical discussion of the orbitally ordered systems is based mainly on the considerations in the strong-correlation limit. This is particularly so for the manganites and related compounds. We have addressed the question at what values of the interactions (i.e. of the magnitudes of the Hubbard constant U and of the Hund's-rule exchange integral J) the combined alternant orbital-spin ferromagnetic ordering sets in [1]. We have calculated the phase diagram near the quarter filling for a doubly degenerate correlated band. The results interpolate between the Hartree-Fock and strong-correlation limits. The comparison with the results for an onset of antiferromagnetism in an orbitally-nondegenerate-band case is also made. We have also shown [2] that the Hund's rule can lead to a spin-triplet pairing, which may *coexist* with ferromagnetism. In fact, this *interorbital* paired state can destabilize the orbitally ordered insulating phase for a sufficiently strong J . Although our calculations are of a model type (we take a simplified band structure), they point to the appearance of new physics in the intermediate- and strong-correlation regimes for the orbitally degenerate and correlated systems.

[1] A. Klejnberg and J. Spalek, Phys. Rev. B61, 25542 (2000).

[2] J. Spalek, Phys. Rev. B63, 104513 (2001); A. Klejnberg and J. Spalek, J. Phys.: Condens. Matter 11, 6553 (1999).